Best Practices for Engaging Students: Do's and Don't of Using Active and Cooperative Learning

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To teach is to engage students in learning*; thus teaching consists of getting students involved in the active construction of knowledge. . .The aim of teaching is not only to transmit information, but also to transform students from passive recipients of other people's knowledge into active constructors of their own and others' knowledge. . .Teaching is fundamentally about creating the pedagogical, social, and ethical conditions under which* ***students agree to take charge of their own learning, individually and collectively***

Education for judgment: The artistry of discussion leadership. Edited by C. Roland Christensen, David A. Garvin, and Ann Sweet. Cambridge, MA: Harvard Business School, 1991.

Lila M. Smith

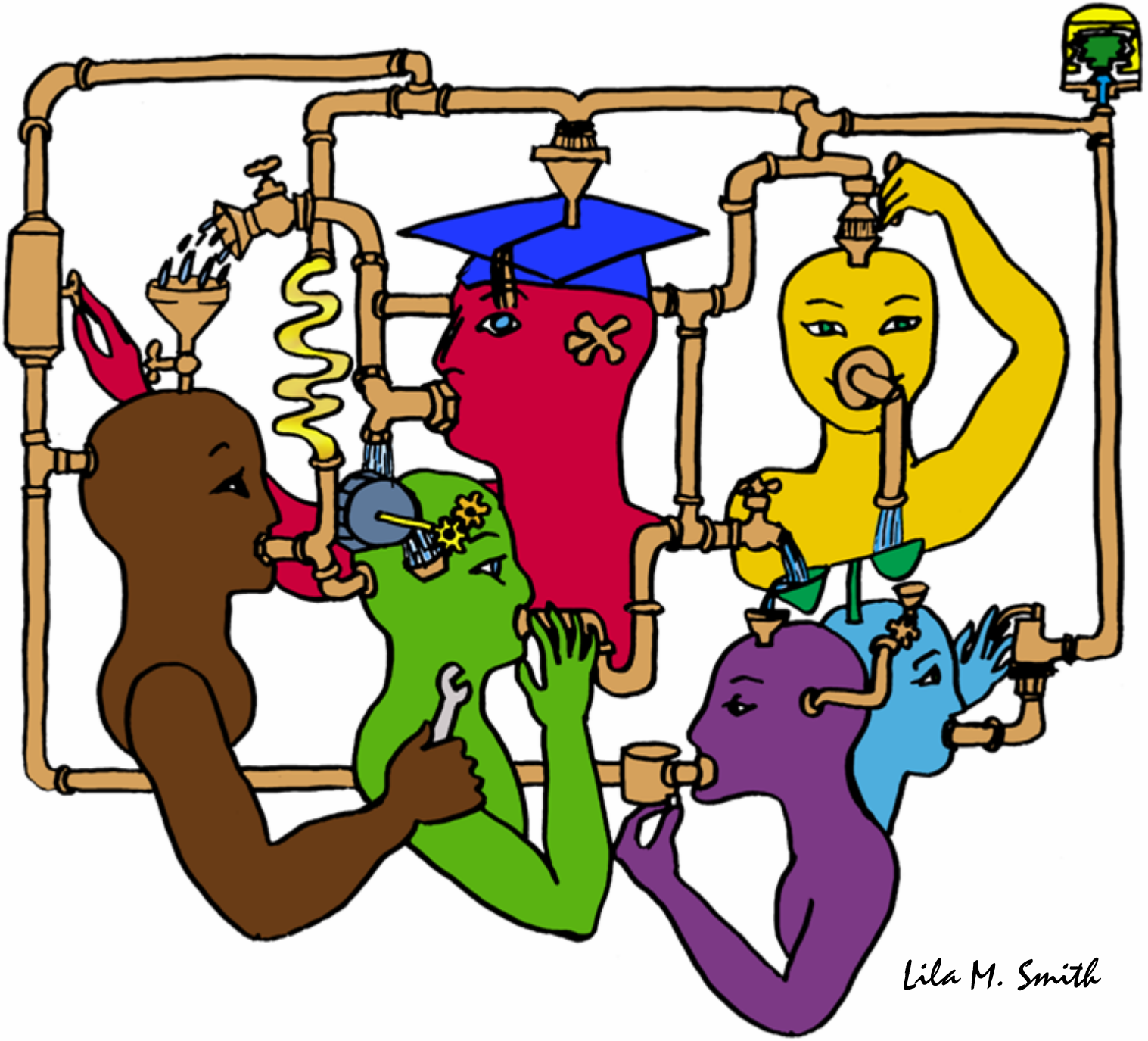
Pedago-pathologies – Lee Shulman

Amnesia

Fantasia

Inertia

Shulman, Lee S. 1999. Taking learning seriously. *Change, 31* (4), 11-17.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Active/Cooperative Learning, Learning Community Success Story

Reflect on and Talk about your Active/Cooperative Learning, Learning Community Success(es)

1. Context?
2. Structure/Procedure?
3. Outcome?

Key Features of Cooperative Learning

Active/Interactive
Cooperative
Personal (before professional)
Structure (before task)
Knee-to-Knee, Eye-to-Eye/Space/Focus
Challenging task (worthy of group effort)
Students talking through the material (cognitive rehearsal)
Learning groups are small (2-5) and assigned
Heterogeneous
Your own cooperative group

Getting Students Actively Involved Using Cooperative Learning: Principles, Strategies, and Problem-Solving

What is it? How do you do it? Why bother?

Cooperative Learning is instruction that involves people working in teams to accomplish a common goal, under conditions that involve both *positive interdependence* (all members must cooperate to complete the task) and *individual and group accountability* (each member is accountable for the complete final outcome).

Key Concepts

- Positive Interdependence
- Individual and Group Accountability
- Face-to-Face Promotive Interaction
- Teamwork Skills
- Group Processing

Cooperative Learning

Positive Interdependence

Task Interdependence
1. Factory line
2. Chain Reaction

Identity Interdependence
Mutual identity (name, motto, etc.)

Resource Interdependence
1. Limit resources (one set of materials)
2. Jigsaw materials
3. Separate Contributions

Environmental Interdependence
1. Designated classroom space
2. Group has special meeting place

Duty (Role) Interdependence
Assign each member a role and rotate them

Fantasy Interdependence
Hypothetical interdependence in situation ("You are a scientific/literary prize team, lost on the moon, etc.")

Reward/Celebration Interdependence
1. Celebrate joint success
2. Bonus points
3. Nonacademic rewards (Food, free time, etc.)
4. Single group grade (when fair to all)

Outside Challenge Interdependence
1. Intergroup competition
2. Other class competition

Goal Interdependence (essential)
1. All members show mastery
2. All members improve
3. Add group member scores to get an overall group score
4. One product from group that all helped with and can explain

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Individual Accountability

Ways to ensure no slackers:

- Keep group size small
- Assign roles
- Randomly ask one member of the group to explain the learning
- Have students do work before group meets
- Have students use their group learning to do an individual task afterward
- Everyone signs: "I participated, I agree, and I can explain the information"
- Observe & record individual contributions

Ways to ensure that all members learn:

- Practice tests
- Edit each other's work and sign agreement
- Randomly check one paper from each group
- Give individual tests
- Assign the role of **checker** who has each group member explain out loud
- Simultaneous explaining: each student explains their learning to a new partner.

Face-to-Face Interaction

Structure:

- Time for groups to meet
- Group members close together
- Small group size of two or three
- Frequent oral rehearsal
- Strong positive interdependence
- Commitment to each other's learning
- Positive social skill use
- Celebrations for encouragement, effort, help, and success

Foundation Coalition - Netscape

File Edit View Go Communicator Help

Back Forward Reload Home Search Netscape Print Security Shop Stop

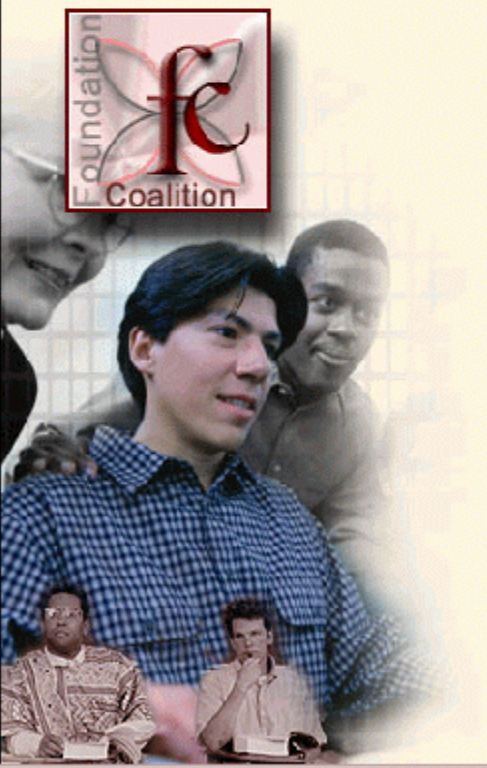
Bookmarks Location: http://clte.asu.edu/active/main.htm

Active/Cooperative Learning: Best Practices in Engineering Education

A Dissemination Project of the Foundation Coalition

Overview of A/CL | Preparing Students | Planning A/CL Lessons | Implementing A/CL | Lessons & Activites | Participant Profiles

Active/Cooperative Learning : Best Practices in Engineering Education



A Dissemination Project of the Foundation Coalition

http://www.foundationcoalition.org

Welcome from the Principal Investigator

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Copyright Information

Acknowledgements

http://clte.asu.edu/active

Document: Done

New Paradigm

- Defining educational objectives, facilitating development of critical and creative thinking and problem-solving skills
- Active learning (individual and group activities in class)
- Structured cooperative learning (including multidisciplinary teamwork and facilitating development of written and oral communication skills)
- Writing and (multidisciplinary) design across the curriculum
- Inquiry and discovery learning (problem-based, case-based)
- Teaching to diversity (different learning styles, ethnicities, genders)
- Appropriate use of technology (tools, simulation, exploration)

National Science Foundation – Shaping the Future: New Expectations for Undergraduate Education in Science, Mathematics, Engineering and Technology

Goal – *All students have access to supportive, excellent undergraduate education in science, mathematics, engineering, and technology, and all students learn these subjects by direct experience with the methods and processes of inquiry.*

Recommend that *SME&T faculty:* Believe and affirm that every student can learn, and model good practices that increase learning; starting with the student's experience, but have high expectations within a supportive climate; and build inquiry, a sense of wonder and the excitement of discovery, plus communication and teamwork, critical thinking, and life-long learning skills into learning experiences.

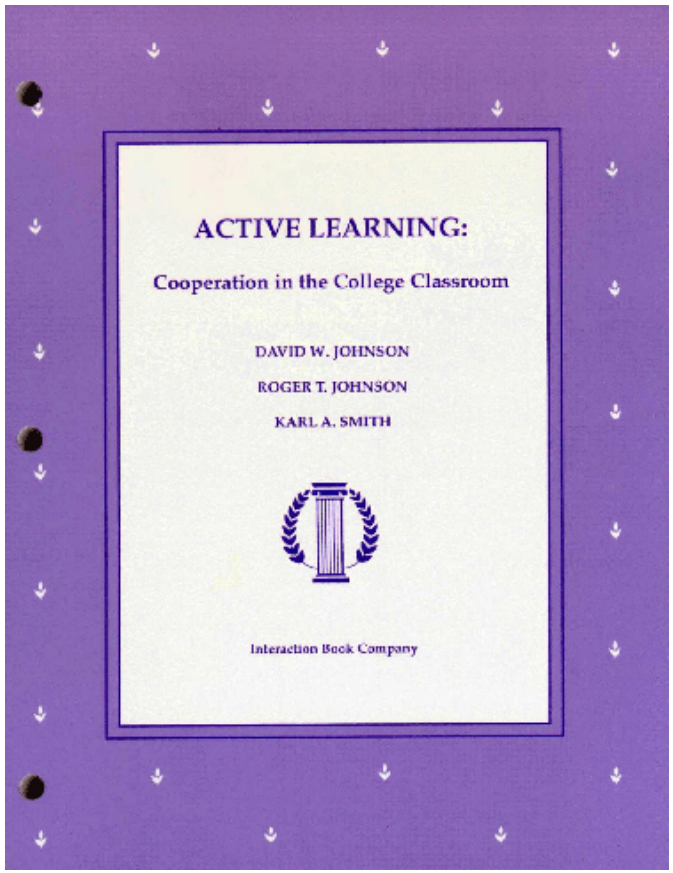
Tracking Change - Seymour

"The greatest single challenge to SMET pedagogical reform remains the problem of whether and how large classes can be infused with more active and interactive learning methods."

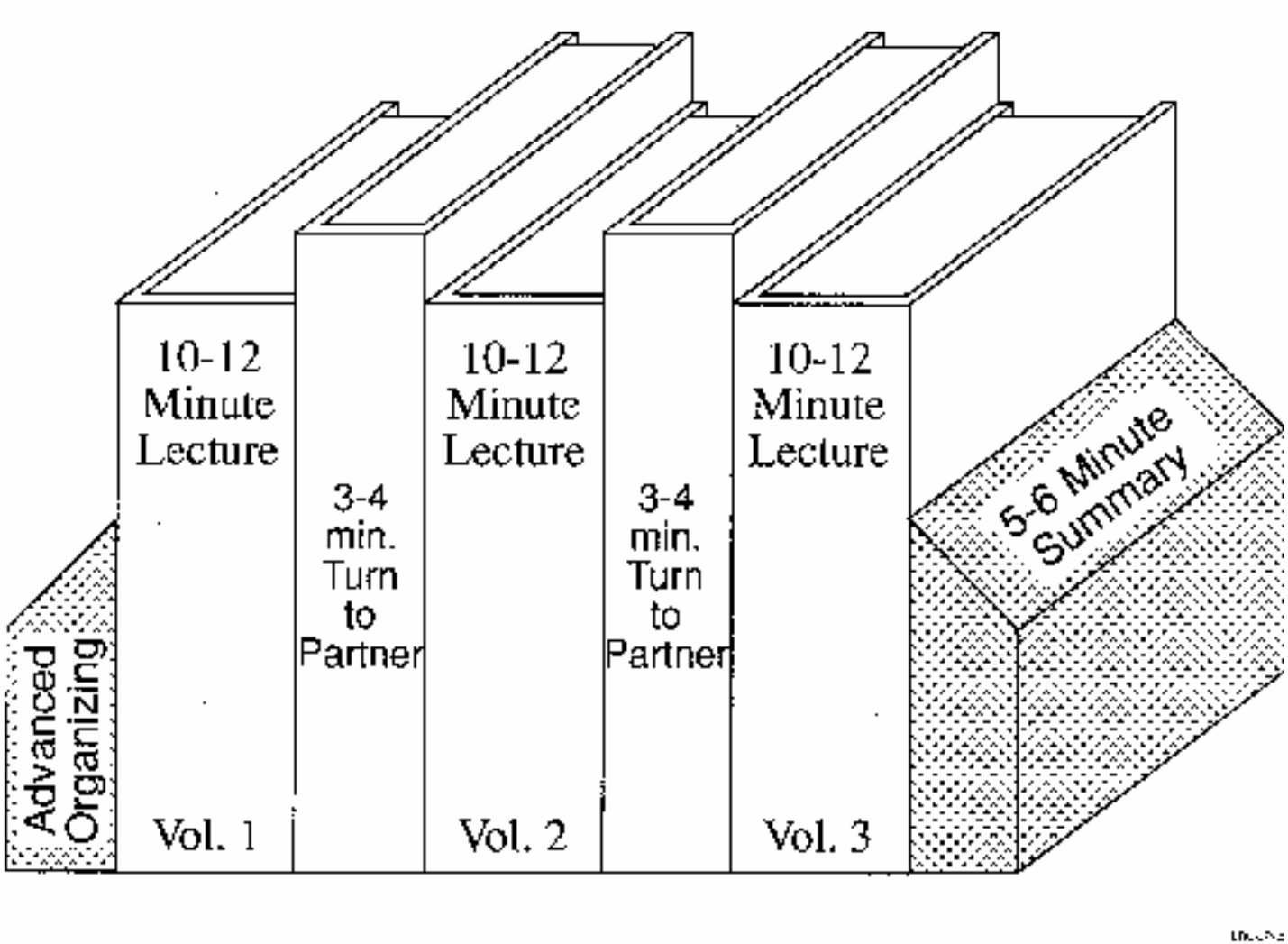
Seymour, Elaine. 2001. Tracking the processes of change in US undergraduate education in science, mathematics, engineering, and technology. Science Education, 86, 79-105.

Active Learning: Cooperation in the College Classroom

- **Informal** Cooperative Learning Groups
- **Formal** Cooperative Learning Groups
- Cooperative **Base** Groups



Book Ends on a Class Session



Book Ends on a Class Session

1. Advance Organizer
2. Formulate-Share-Listen-Create (Turn-to-your-neighbor) -- repeated every 10-12 minutes
3. Session Summary (Minute Paper)
    1. What was the most useful or meaningful thing you learned during this session?
    2. What question(s) remain uppermost in your mind as we end this session?
    3. What was the “muddiest” point in this session?

Advance Organizer

"The most important single factor influencing learning is what the learner already knows. Ascertain this and teach him accordingly."

David Ausubel - Educational psychology: A cognitive approach, 1968.

Formulate-Share-Listen-Create

Informal Cooperative Learning Group
Introductory Pair Discussion of a

FOCUS QUESTION

1. Formulate your response to the question **individually**
2. Share your answer with a partner
3. Listen carefully to your partner's answer
4. Work together to Create a new answer through discussion

Engage

Describe Your Favorite Way to Find Out What Students Know

1. **Formulate** your response to the question individually
2. **Share** your answer with a partner
3. **Listen** carefully to your partner's answer
4. Work together to **Create** a new answer through discussion

Quick Thinks

- Reorder the steps
- Paraphrase the idea
- Correct the error
- Support a statement
- Select the response

Johnston, S. & Cooper,J. 1997. Quick thinks: Active-thinking in lecture classes and televised instruction. Cooperative learning and college teaching, 8(1), 2-7.

Minute Paper

- What was the most useful or meaningful thing you learned during this session?
- What question(s) remain uppermost in your mind as we end this session?
- What was the “muddiest” point in this session?
- Give an example or application
- Explain in your own words . . .

Angelo, T.A. & Cross, K.P. 1993. Classroom assessment techniques: A handbook for college teachers. San Francisco: Jossey Bass.

Informal CL (Book Ends on a Class Session) with Concept Tests

Physics

Peer Instruction

Eric Mazur - Harvard – http://galileo.harvard.edu

Peer Instruction – www.prenhall.com

Richard Hake – http://www.physics.indiana.edu/~hake/

Chemistry

Chemistry ConcepTests - UW Madison – www.chem.wisc.edu/~concept

Video: Making Lectures Interactive with ConcepTests

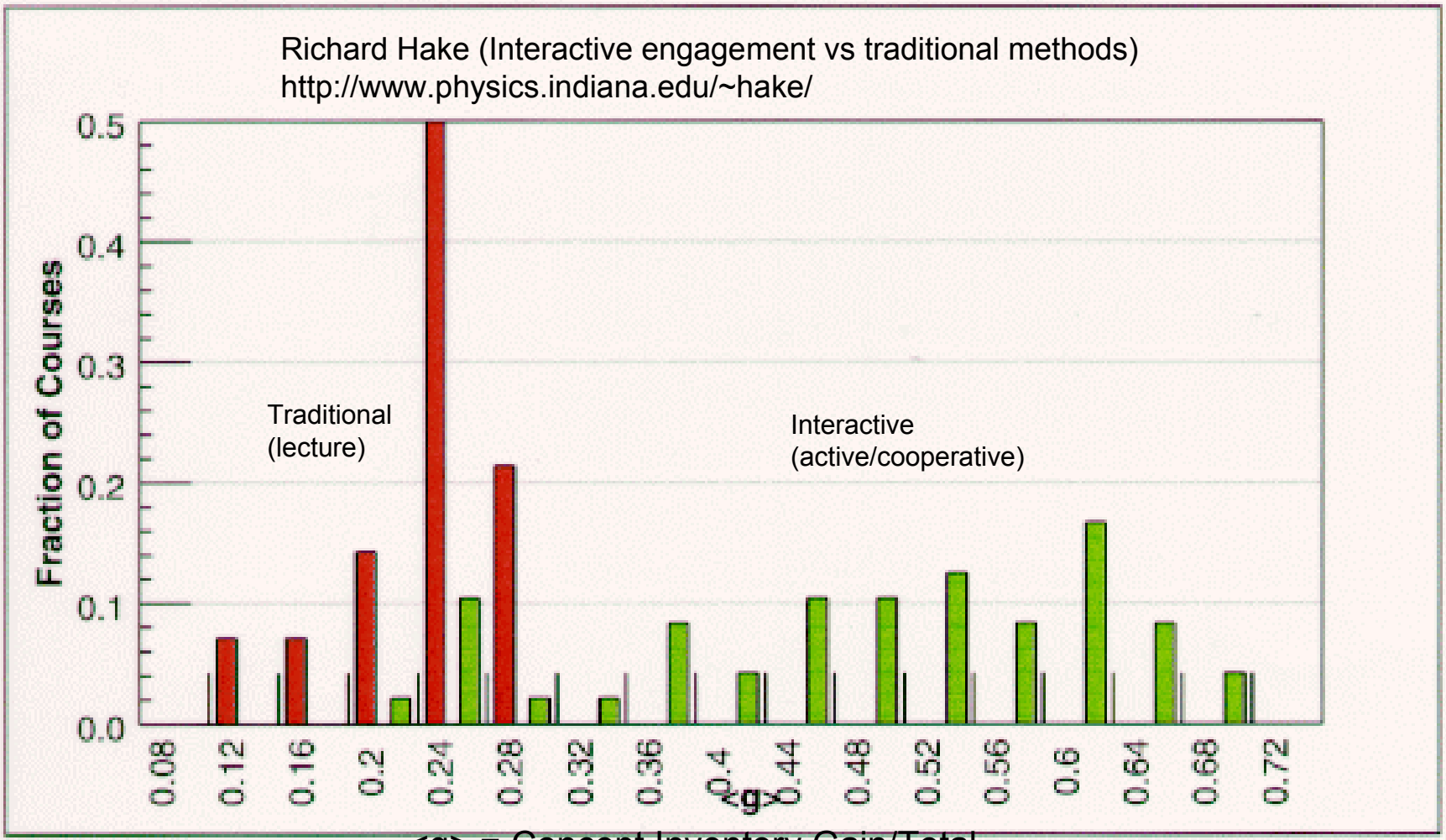
ModularChem Consortium – http://mc2.cchem.berkeley.edu/

STEMTEC

Video: How Change Happens: Breaking the "Teach as You Were Taught" Cycle – Films for the Humanities & Sciences – www.films.com

Thinking Together video: Derek Bok Center – www.fas.harvard.edu/~bok_cen/

Richard Hake (Interactive engagement vs traditional methods)
http://www.physics.indiana.edu/~hake/



<g> = Concept Inventory Gain/Total

Fig. 2. Histogram of the average normalized gain <g>: dark (red) bars show the *fraction* of 14 traditional courses (N = 2084), and light (green) bars show the *fraction* of 48 interactive engagement courses (N = 4458), both within bins of width $\delta\langle g\rangle = 0.04$ centered on the <g> values shown.

III. CONCEPTUAL TEST RESULTS

A. Gain vs Pretest Graph - All Data

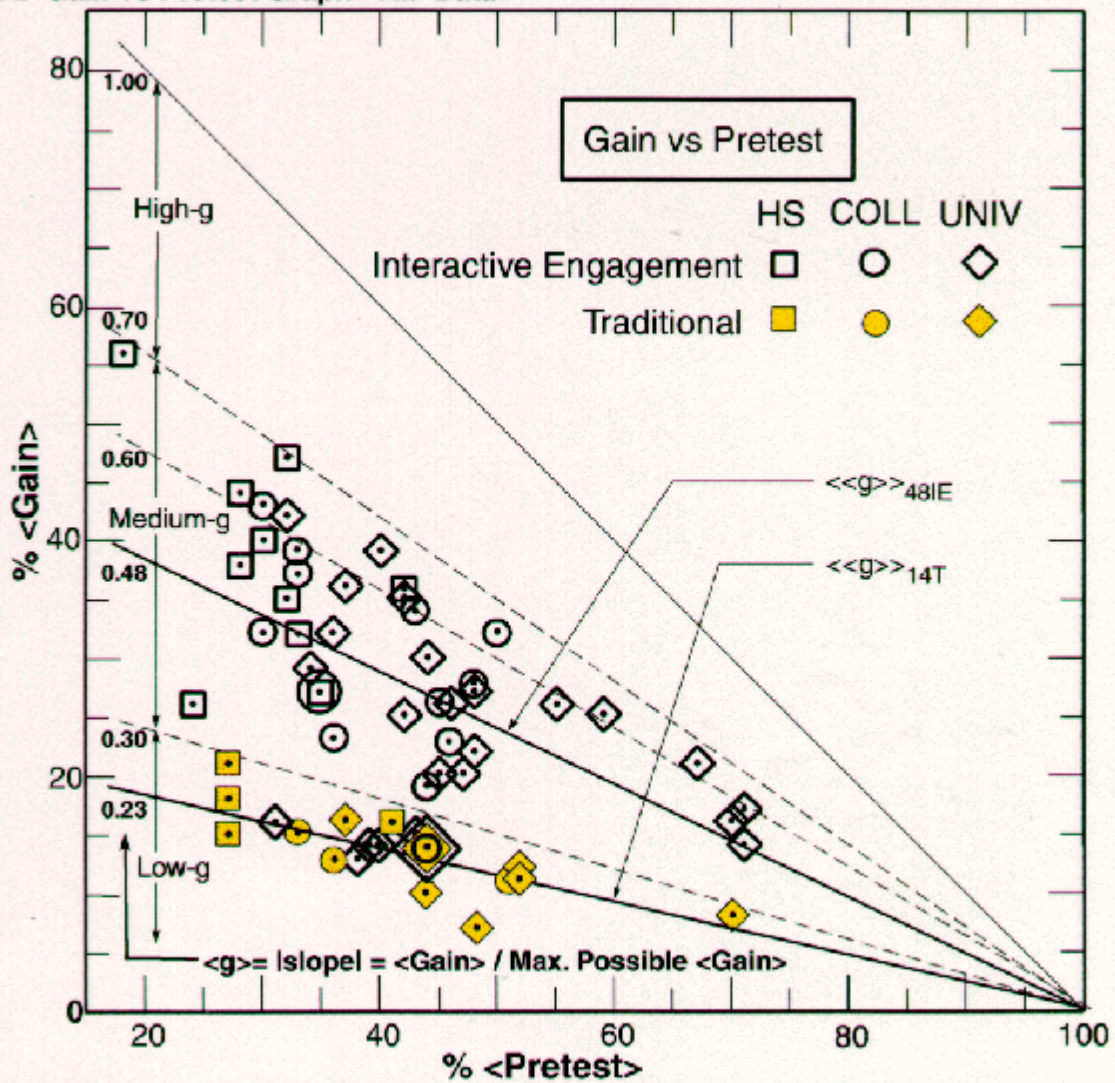


Fig. 1. %<Gain> vs %<Pretest> score on the conceptual Mechanics Diagnostic (MD) or Force Concept Inventory (FCI) tests for 62 courses enrolling a total N = 6542 students: 14 traditional (T) courses (N = 2084) which made little or no use of interactive engagement (IE) methods, and 48 IE courses (N = 4458) which made considerable use of IE methods. Slope lines for the average of the 14 T courses $\langle\langle g\rangle\rangle_{14T}$ and 48 IE courses $\langle\langle g\rangle\rangle_{48IE}$ are shown, as explained in the text.

Session Summary
(Minute Paper)

Reflect on the session:

1. What were the most important points for you?
2. What is one thing you would be willing to try?
3. What questions do you have?

Discuss with a partner:

1. Points that were useful, meaningful, interesting, applicable, etc.
2. Questions that you have.

Informal Cooperative Learning Groups

Can be used at any time
Can be short term and ad hoc
May be used to break up a long lecture
Provides an opportunity for students to process material they have been listening to (Cognitive Rehearsal)
Are especially effective in large lectures
Include "book ends" procedure
Are not as effective as Formal Cooperative Learning or Cooperative Base Groups

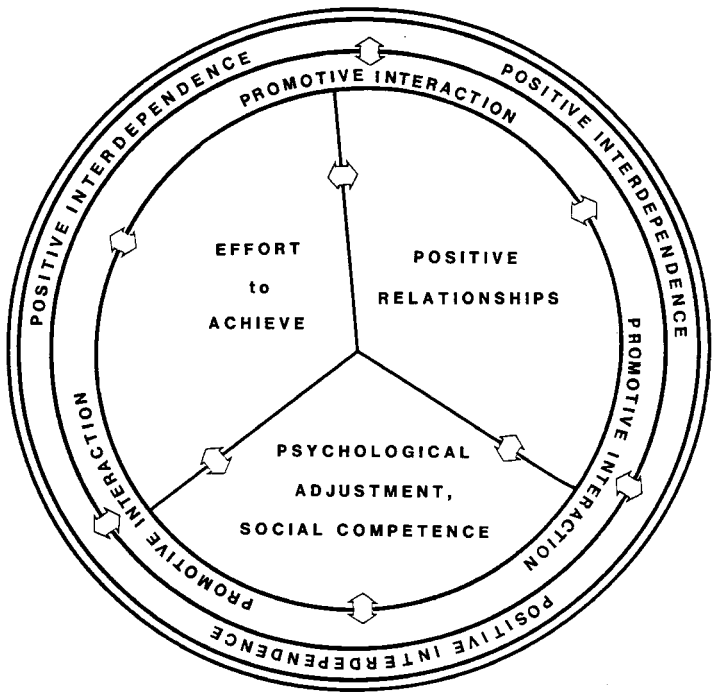
Cooperative Learning Research Support

Johnson, D.W., Johnson, R.T., & Smith, K.A. 1998. Cooperative learning returns to college: What evidence is there that it works? *Change*, *30* (4), 26-35.

- Over 300 Experimental Studies
- First study conducted in 1924
- High Generalizability
- Multiple Outcomes

Outcomes

1. Achievement and retention
2. Critical thinking and higher-level reasoning
3. Differentiated views of others
4. Accurate understanding of others' perspectives
5. Liking for classmates and teacher
6. Liking for subject areas
7. Teamwork skills



Small-Group Learning: Meta-analysis

Springer, L., Stanne, M. E., & Donovan, S. 1999. Effects of small-group learning on undergraduates in science, mathematics, engineering, and technology: A meta-analysis. Review of Educational Research, 69(1), 21-52.

Small-group (predominantly cooperative) learning in postsecondary science, mathematics, engineering, and technology (SMET). 383 reports from 1980 or later, 39 of which met the rigorous inclusion criteria for meta-analysis.

The main effect of small-group learning on achievement, persistence, and attitudes among undergraduates in SMET was significant and positive. Mean effect sizes for achievement, persistence, and attitudes were 0.51, 0.46, and 0.55, respectively.

Formal Cooperative Learning Task Groups

Formal Cooperative Learning

1. Jigsaw
2. Peer Composition or Editing
3. Reading Comprehension/Interpretation
4. Problem Solving, Project, or Presentation
5. Review/Correct Homework
6. Constructive Academic Controversy
7. Group Tests

Problem Based Cooperative Learning Format

TASK: Solve the problem(s) or Complete the project.

INDIVIDUAL: Estimate answer. Note strategy.

COOPERATIVE: One set of answers from the group, strive for agreement, make sure everyone is able to explain the strategies used to solve each problem.

EXPECTED CRITERIA FOR SUCCESS: Everyone must be able to explain the strategies used to solve each problem.

EVALUATION: Best answer within available resources or constraints.

INDIVIDUAL ACCOUNTABILITY: One member from your group may be randomly chosen to explain (a) the answer and (b) how to solve each problem.

EXPECTED BEHAVIORS: Active participating, checking, encouraging, and elaborating by all members.

INTERGROUP COOPERATION: Whenever it is helpful, check procedures, answers, and strategies with another group.

Professor's Role in Formal Cooperative Learning

1. Specifying Objectives
2. Making Decisions
3. Explaining Task, Positive Interdependence, and Individual Accountability
4. Monitoring and Intervening to Teach Skills
5. Evaluating Students' Achievement and Group Effectiveness

Cooperative Base Groups

- Are Heterogeneous
- Are Long Term (at least one quarter or semester)
- Are Small (3-5 members)
- Are for support
- May meet at the beginning of each session or may meet between sessions
- Review for quizzes, tests, etc. together
- Share resources, references, etc. for individual projects
- Provide a means for covering for absentees

Cooperative Learning: Advice for Starting Out

- Start small, Start Early, and Build
- Group size of 2 or 3
- YOU choose the groups
- Tell students what you're doing and why (Inform students before starting)
- Do something cooperative regularly, build habits of cooperation
- Keep it short; 5 to 10 minutes and gradually expand time
- Mention important group behaviors--listening, staying on task, participating, checking for understanding
- No formal, outside of class, group projects until students are working well together
- Monitor the groups: listen, ask questions, and clarify; intervene (stop the group) only when absolutely necessary
- Be patient, be positive and problem-solve
- Work with a colleague
- Rule: No student's grade should be lower because of cooperative learning. Evaluation for learning should be individual until you and the students are ready for group grades. Explore alternatives to giving group grades for group work. DON'T give group grades until you and the students are ready

When Faculty Have Problems, I Check For:

- Group size of 2 or 3; Members close together
- Positive Interdependence structured in multiple ways; Individual Accountability clear
- Criterion-referenced evaluation system; No group grade until fair
- Lessons short: 5 - 20 minutes
- Vigorous monitoring to promote academic and teamwork success
- Teamwork skills emphasized
- Processing carefully and regularly done
- Regular meetings with colleagues